Efficient Automated Smart Parking System Based on Android

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ABSTRACT

Internet-Of-Things (IOT) & Smart Phone plays an important role in today's for connecting the world. IOT connects non-internet things to make them available from remote locations in all over. In Existence system, the common method of finding a parking space is manual where the driver usually finds a space in the street through luck and experience. This process takes time and effort and may lead to the worst case of failing to find any parking space if the driver is driving in a city with high vehicle density. Here we are proposing an android based application for smart phone for interaction between smart parking system and user. Here we are using a shortest path algorithm for proposed system which will lead to finding the nearest parking space for vehicle. The system is based on Smart phone & GPS of vehicle or mobile devices to avoid human intervention.

Keyword: - *Android Application, Automated Parking System, KNN Technique, NNS Algorithm*

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1. Introduction

Searching for street parking in crowded urban areas creates many problems and frustrations for drivers. It has been shown that over 40% of the total traffic volume in urban areas is composed of vehicles cruising for parking [1]. A long queue of cruising vehicles can cause serious congestion with the blocking of only a few streets.

With the rapid proliferation of vehicle availability and usage in recent years, finding a vacant car parking space is becoming more and more difficult and time consuming. This results in a number of practical conflicts. Parking problems are becoming ubiquitous and ever growing at an alarming rate in every major city. The use of android technology combined with the recent advances in wireless applications could be the key to solve emerging parking problems.

The main idea behind the Automated Car Parking System is to help the user analyze area's where parking is available and number of slots free in that area. The user can pre-book a slot in the area he desires if it is available some hours prior to his expected arrival. This will help reduce the load on the administrator as his physical work reduces drastically. The user can search the parking slot through Android Application and pre-book the slot. Payment services are made available using Google Thus the application proposed in this paper makes the user relief free as it reduces the time required for manually searching and waiting for empty slots to park the vehicle.

2. Related Work done

Various methods are present for development of intelligent parking systems. Many of the existing systems require a little or more human intervention for the functioning.

One of the intelligent systems for car parking has been proposed by making use of Image processing [2]. In this system, a brown rounded image on the parking slot is captured and processed to detect the free parking slot. The information about the currently available parking slots is displayed on the 7-segment display.

A vision based car parking system [3] is developed which uses two types of images (positive and negative) to detect free parking slot. In this method, the object classifier detects the required object within the input. Positive images contain the images of cars from various angles. Negative images do not contain any cars in them. The co-ordinates of parking lots specified are used as input to detect the presence of cars in the region. However, limitations may occur with this system with respect to the type of camera used. Also, the co-ordinate system used selects specific parking locations and thus camera has to be at a fixed location. Limited set of positive and negative images may impose limitations on the system.

Smart Parking system [4] designed proposed a mechanical model with an image processing facility. The car would be parked with the use of lift at multiple levels. Also, image processing is used to capture the number plate and store in database for comparison to avoid illegal car entry.

Thus, in this paper a car parking system is proposed that is a fully automated model with minimum human intervention. It also overcomes the limitations of existing systems

3. Proposed System Architecture

The proposed application is based on the client-server architecture. The client is provided with an interactive Android based user interface for the process of pre-booking of parking slot. The server side processing will be enabled using Java and MySQL. The client requests the server for locations where parking is available and the server responds with slots availability.
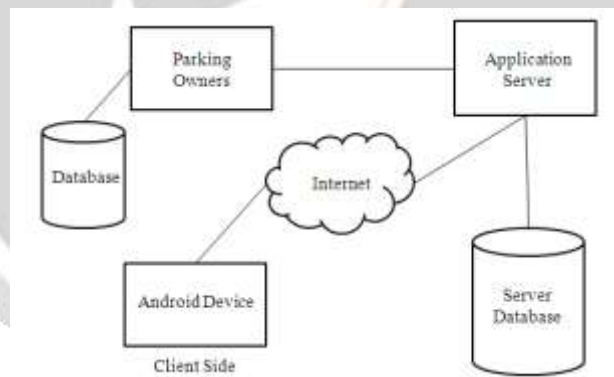
Fig(a): Proposed System Architecture

The client pre-books a parking slot by giving his/her vehicle number. At server side, that particular slot is reserved and a buffer time is set for that particular client. The buffer time is the time that client will require to reach to the parking slot from his/her current location. If the client does not reach the parking area in estimated time then server removes the reservation from that slot.

3.1 Client Side Features
1. Starting the application
The user needs to install the "Park Me" application on his Android based device. After installation, the icon of the app will feature on the Home Screen of the user's device.

2. Registration

Initially, the user has to register his details with the application for the first time. This is a one-time registration. The user has to enter details like username, gender, phone number and email-id. All this data will be stored on server. Booking for slots mandatorily has to be done four hours prior to arrival.

3. Selection of Location for Parking
The client is provided with multiple parking locations. Client has to select one of the locations provided where he desires to park the vehicle.

4. Availability status of the slots
Based on the location selected availability of the empty slots will be displayed on client's device. Colour coding is used to indicate empty v/s reserved slots.

5. Enter client's details for slot reservation
In case the slot required by client is available, the client can proceed further with the reservation process or else he can go back to change the location or else can terminate the entire process.

6. Confirmation
On successful reservation, a confirmation page with user details and parking location is shown on client's device.

3.2 Server Side Features
The server side processing will be developed using Java and MySQL. The administrator has to register his details with the server side application. This is also one time registration. Whenever a new user registers with the application, the record will be stored in the server side database. When the registered user selects the location, immediately server receives the client's request. After receiving the request for the desired location, server processes the related information and responds accordingly.

4. Algorithm

The proposed system uses the Nearest Neighbor Search Algorithm for finding parking locations that are nearest to the client's current location. Nearest neighbor search (NNS), also known as proximity search, similarity search or closest point search, is an optimization problem for finding closest (or most similar) points. Closeness is typically expressed in terms of a dissimilarity function: The less similar are the objects, the larger are the function values. Formally, the nearest-neighbor (NN) search problem is defined as follows: given a set S of points in a space M and a query point $q \in M$, find the closest point in S to q. Donald Knuth in vol. 3 of The Art of Computer Programming (1973) called it the post-office problem, referring to an application of assigning to a residence the nearest post office. A direct generalization of this problem is a k-NN search, where we need to find the k closest points.
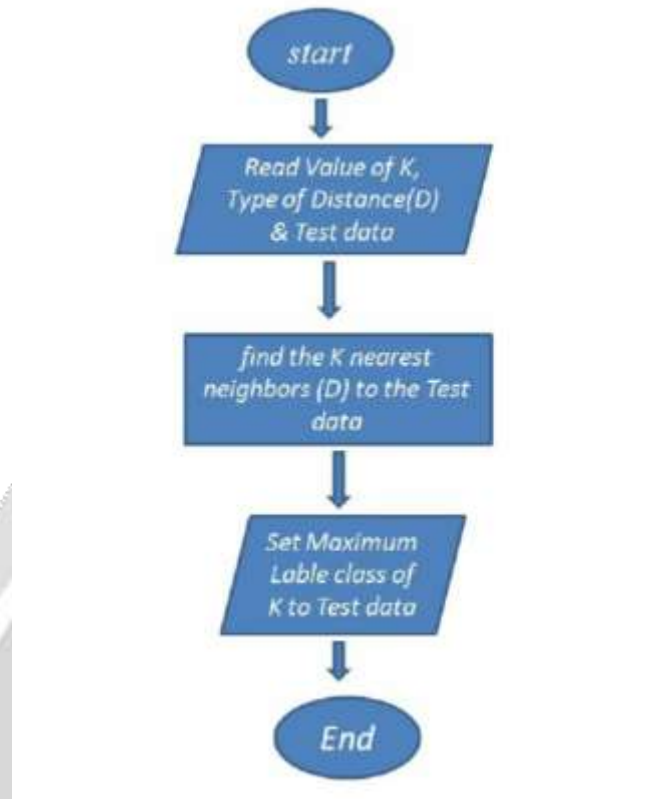
Fig(b): Flowchart of KNN Algorithm

5. Expected Results

The proposed system will have a web application and an android application. The web application will be used by the registered vendors to maintain the status of parking area. The booked and non-booked slots will be displayed on the screen so that the vendor will have a clear idea about the status of parking area. The android application will be used by customers who are willing to use the parking services provided by the user. Through android application user can book a particular parking slot on the basis of vehicle type. Time required by the user to reach the parking location from current location will be calculated by the application and will be notified to the user.

6. Future Scope

In future, the application can be developed for Windows phone, Blackberry and i- Phone. The wallet now used is static but in future the developed application can be linked to real time wallets like Paytm. Payment gateway can also be implemented. The implementation of payment gateway will allow user to pay to the parking vendor using his/her credit card/debit card. If user is needing more time to reach the booked slot he/she can have an option to increase buffer time. The charges of parking services can then be calculated by the buffer time.

7. Conclusion

In India, the problem of parking is disheartening as there is no devised plan in place. As compared to other countries, there is a wide gap between total number of vehicles produced and the number of parking slots. In this paper, an efficient Car Parking Application is proposed which will majorly reduce the parking problem. This paper shows how the parking problem at crowdy places can be handled with a well-thought plan. It helps the clients in finding out the availability of a parking slot, get the availability confirmed, and reach the place within the time slot allotted. It also makes the management easier at administrator side. A well thought parking plan saves the time of clients required for searching a parking slot in rush hours.

8. References

[1] Shoup, D., "Cruising for parking". Transport Policy, 2006

[2] R. Yusnita Fariza Norbaya Norazwinawati Bashruddin, "Intelligent parking space detection system based on image processing", International Journal of Innovation, Management and Technology, 2012.

[3] Hamada R.H. Al-Absi Patrick Sebastian Justin Dinesh Daniel Devaraj Yap Vooi Voon, "Vision-based automated parking system.", 10th International Conference on Information Science, Signal Processing and their Applications, 2010.

[4] M.O. Reze M.F. Ismail A.A. Rokoni M.A.R. Sarkar, "Smart parking system with image processing facility", I.J. Intelligent Systems and Applications, 2012.

[5] M. Fengsheng Yang, Android Application Development Revelation, China Machine Press, 2010.

[6] M. Zhengguo Hu, Jian Wu, Zhenggong Deng,Programming Methodology, National Defence Industry Press, 2008.

[7] M. Junmin Ye, Software Engineering, Tsinghua University Press, 2006.

[8] J. Dongjiu Geng, Yue Suo, Yu Chen, Jun Wen, Yongqing Lu, Remote Access and Control System Based on Android Mobil Phone", Journal of Computer Applications, 2011.

[9] J. Li Lin, Changwei Zou, Research on Cloud Computing Based on Android Platform, 2010.

[10] J. Wolff, T. Heuer, H. Gao, M. Weinmann, S. Voit and U. Hartmann, "Parking monitor system based on magnetic field sensors," IEEE Conf. Intelligent Transportation Systems, 2006.

[11] C.Laugier and F.Thierry, "Sensor-based control architecture for a car-like vehicle", International Conference on Intelligent Robots and Systems, 1998